CHECKOUT & LAUNCH CONTROL SYSTEM

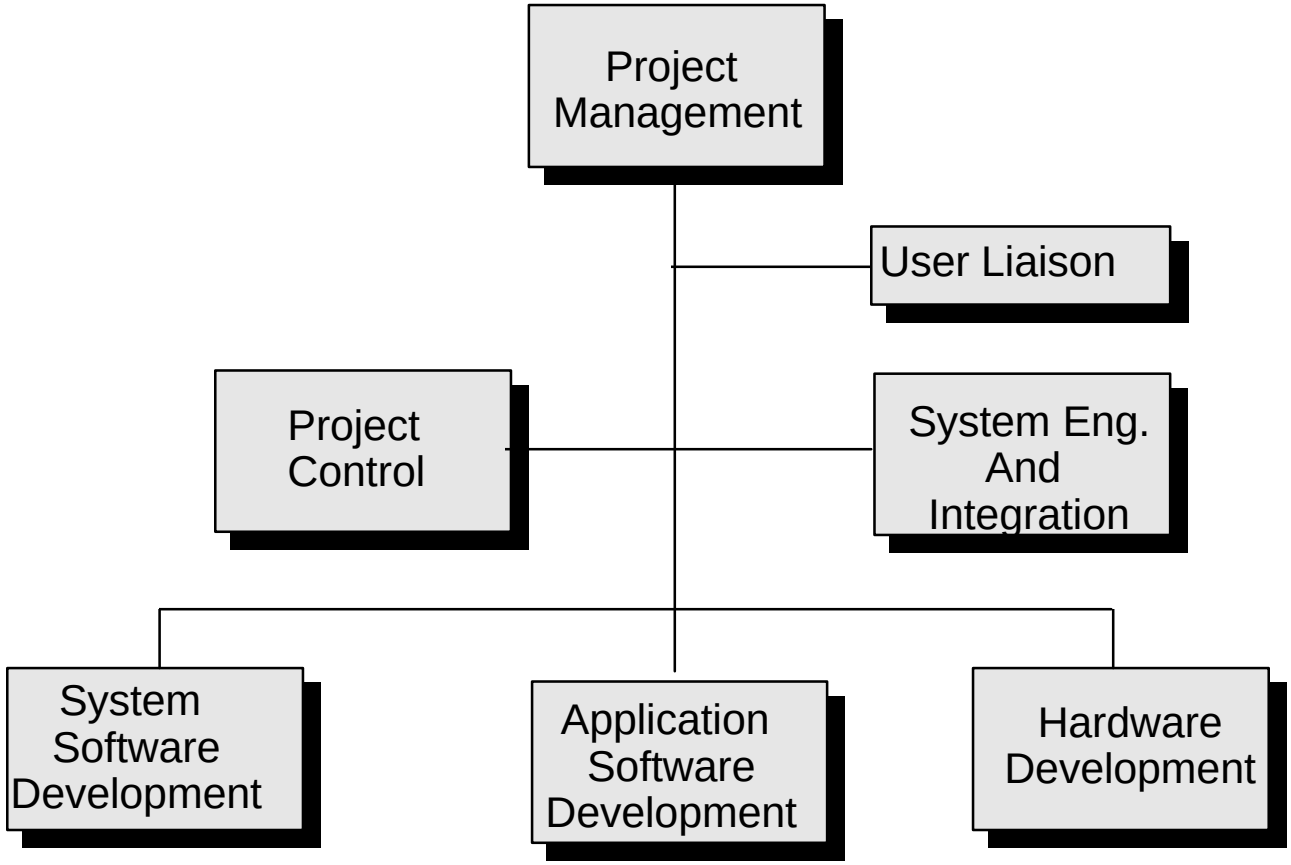
System Engineering Process

Kirk Lougheed - System Engineering and Integration

April 23, 1997

CLCS

System Engineering In CLCS



CLCS Project Level Reviews

- **Architectural Baseline Review - Review Provided at the Discretion of the Project Manager to Capture a "Snapshot" of the System Architecture**
- **Design Panel - Reviews Held Throughout the Development Cycle the Incrementally meet the traditional MIL-STD-1521 Preliminary and Critical Design Reviews**
- **Preliminary and Critical Design Reviews - Reviews Provided at Those Times in the Project Development Cycle Which Coincide With Significant Hardware and Software Procurement Activities**

CLCS System Engineering Approach

- **Provides For Delivery and Long Range System Architecture Design**
- **Provides For Streamlined Documentation Process**
- **Flexible to Accommodate Rapid Deployment Design Techniques**
- **Definition Draws Upon :**
  - **Kennedy Space Center Design Practices**
  - **MIL-STD-2167**
  - **MIL-STD-498**
  - **Mission Control Center Design Practices**

This Presentation will Use CLCS Documents to Describe the System Design Process

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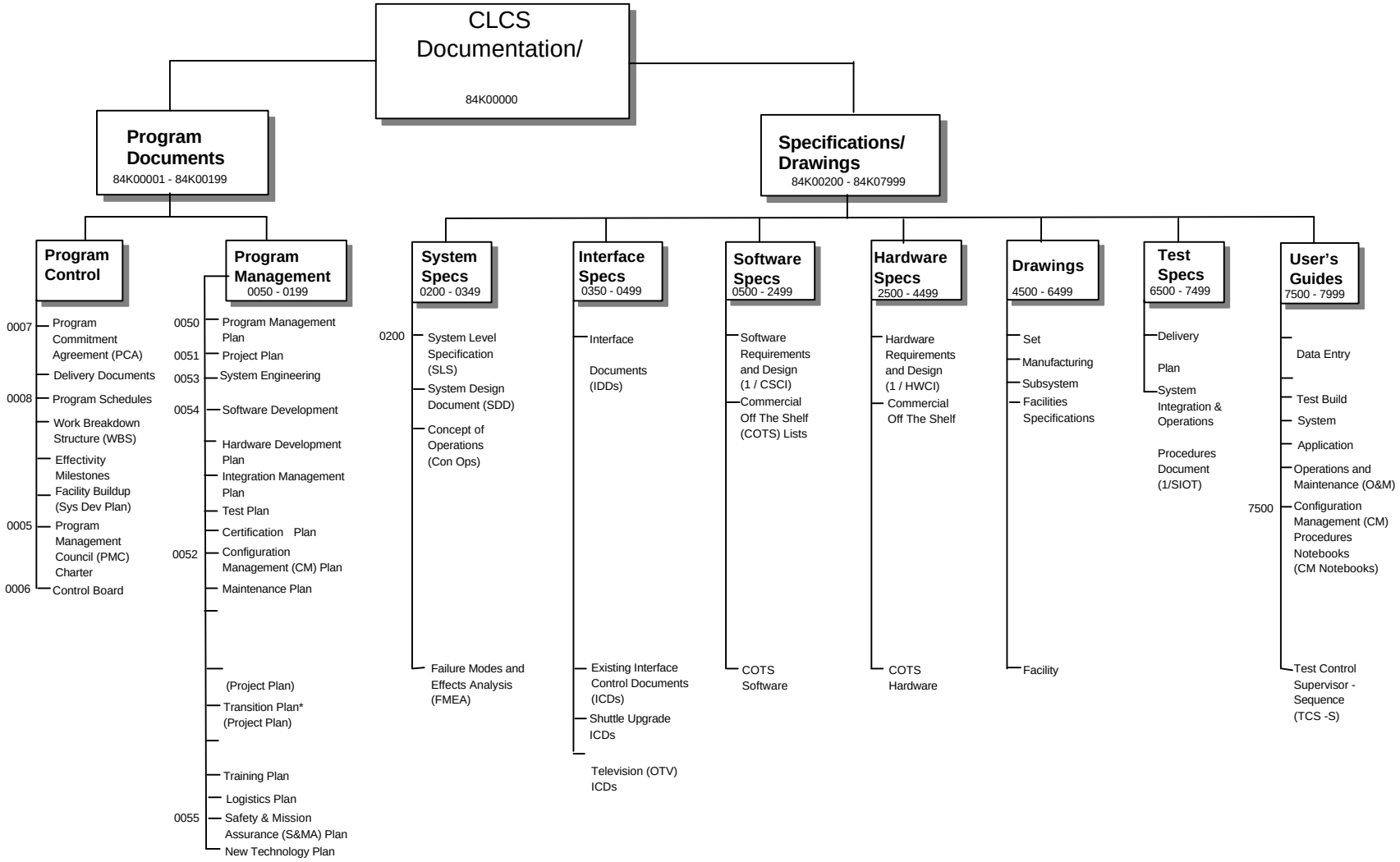
CLCS Documentation Tree



CLCS System Level Documentation

Concept of Operations 84K00220 (Con Ops)

- **Provides System Level Operational Concepts Identified by the User Community For**
  - **Operational Control Rooms (OCR)**
  - **Specialized Processing Sites**
  - **Describes All Activities Required to Define, Prepare and Run Test Operations**

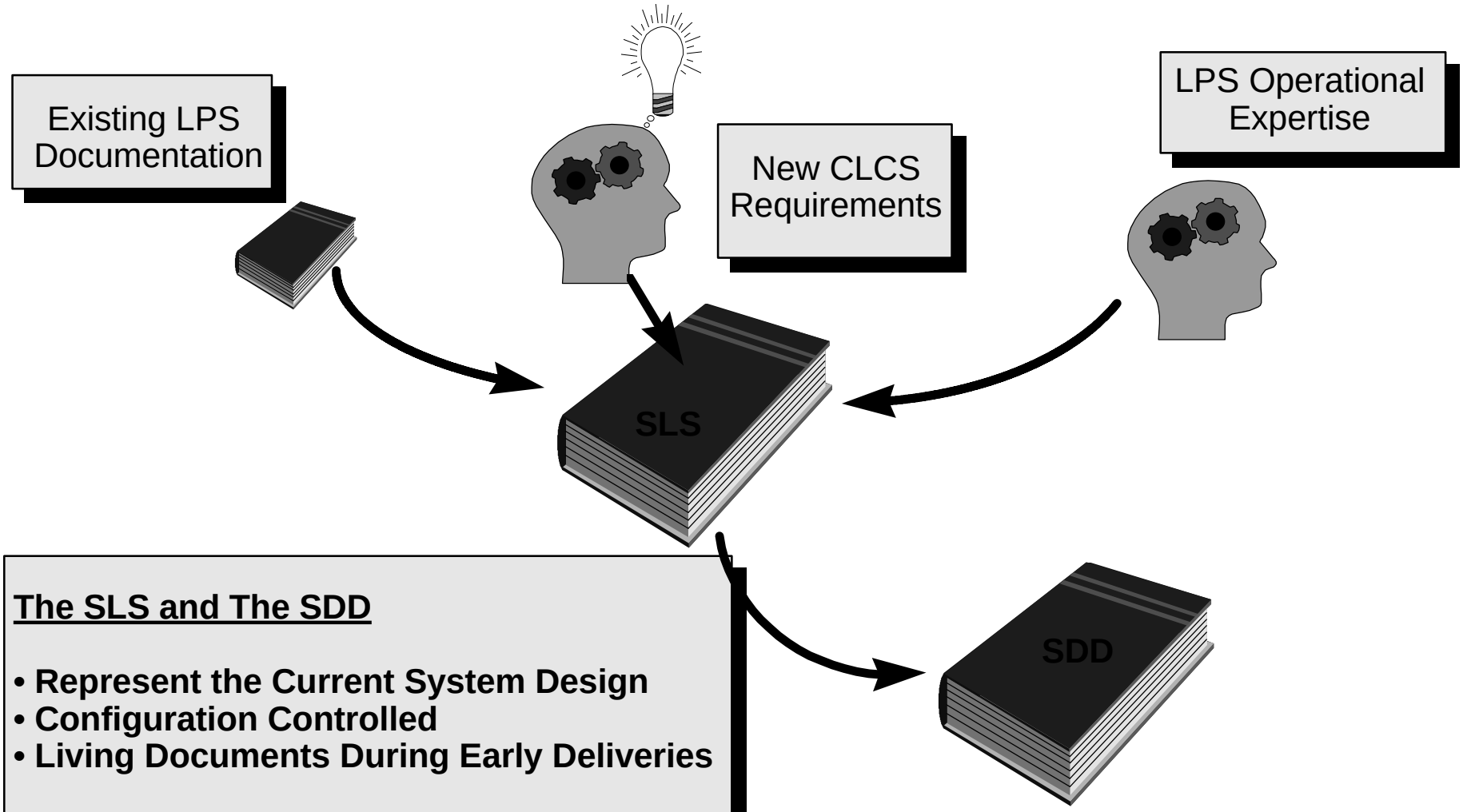
System Level Specification 84K00200 (SLS)

- **Identifies the System Requirements that the basis for the development of the CLCS**
- **Identifies System Level Requirements for**
  - **Real Time Processing System (RTPS)**
  - **Shuttle Data Center (SDC)**
  - **Simulation System (SIM)**
  - **Business Information Network (BIN)**

System Design Document 84K00210 (SDD)

- **Describes the System Architecture of the CLCS**
- **Discusses the Conceptual Mode, Data Flow, Interfaces and Functions of the CLCS**
- **Includes Subsystem Functional Allocation and Hardware and Computer Software Configuration Items Are Defined**

CLCS System Level Documentation
SLS and the SDD Influences



The SLS and The SDD

- **Represent the Current System Design**
- **Configuration Controlled**
- **Living Documents During Early Deliveries**

CLCS "Working" Documents

System Engineering Management Plan (84K00053)

- **Describes the System Engineering Roles and Responsibilities**
- **Describes the CLCS System Design Process**
- **Describes the CLCS Review Process**

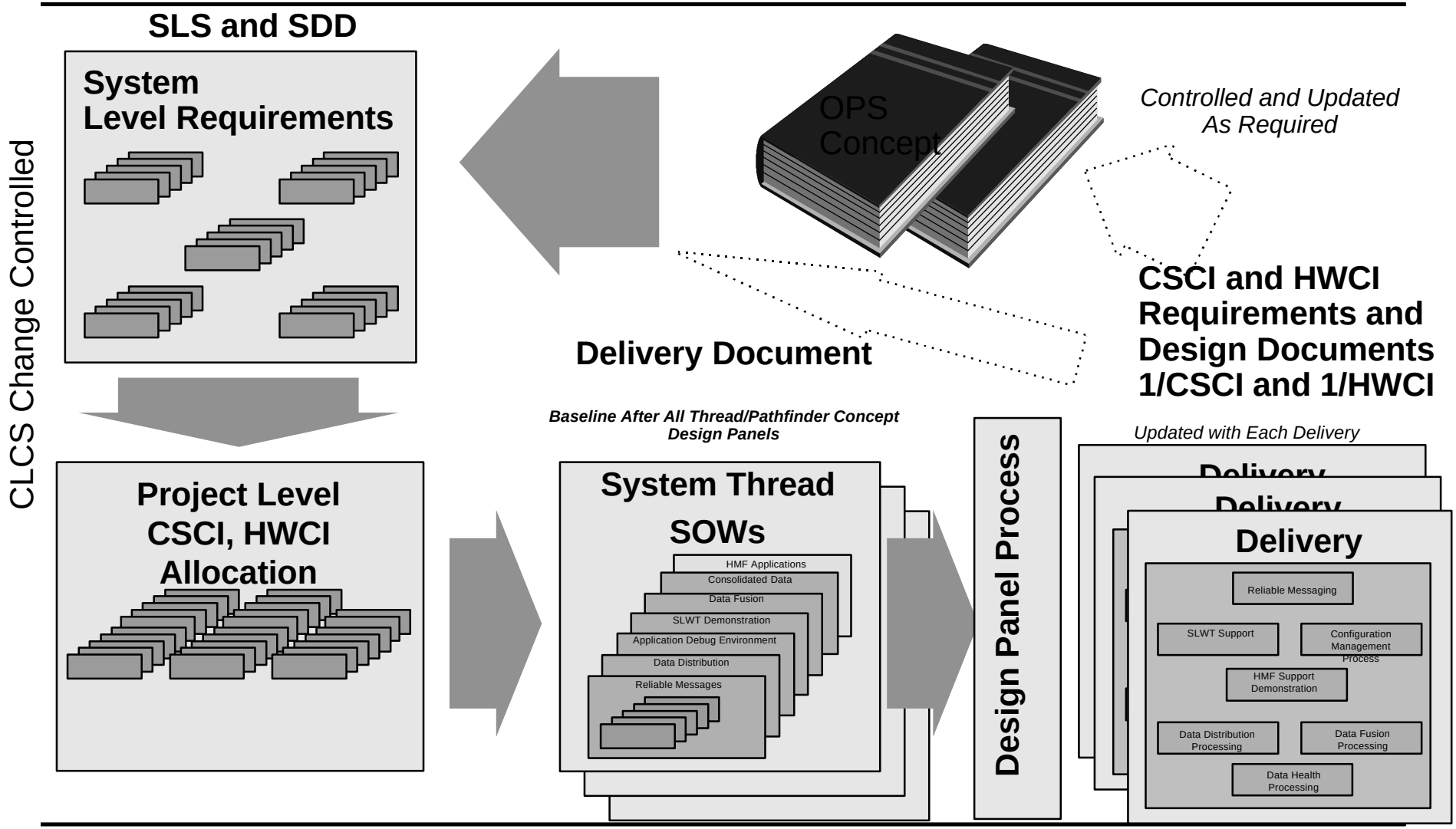
CSCI and HWCI Requirements and Design Documents (1/CSCI and 1/HWCI)

- **Single Design Document Allocated to Each CSCI and HWCI**
- **Evolving Design Document Update With Each Delivery**
- **Contents are a Natural Fall-out of the Design Panel and Development Process**

CLCS Delivery Document

- **Performs a translation from system level specifications to delivery "statement of work"**
- **Could Be considered "mini request for proposal"**
- **Placed under configuration control**

CLCS System Engineering System and Product Documentation Roles



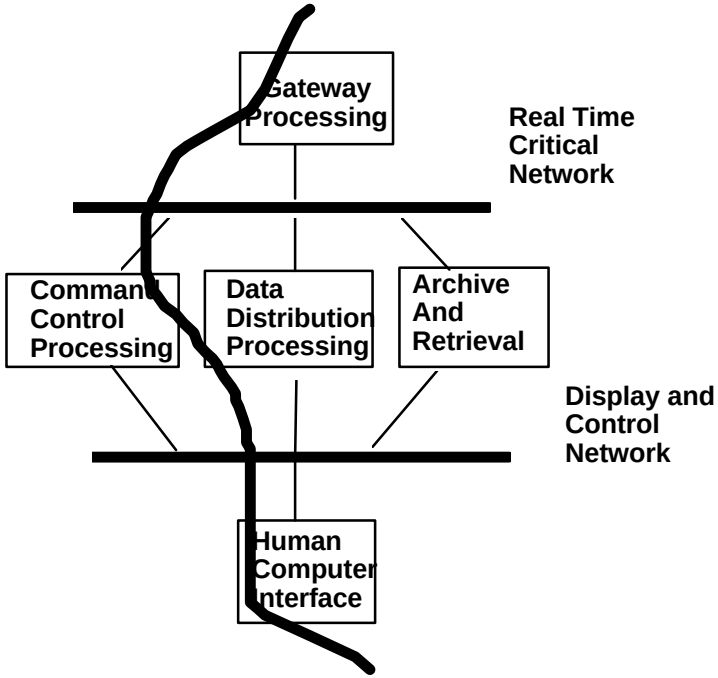
System Engineering Terminology - System Thread

System Thread

A collection of Hardware and Software when combined and integrated as part of a CLCS delivery provides a system wide capability

Threads imply :

- **Quality Oversight in the development process**
- **User Acceptance Testing where applicable**



Thread and Pathfinder Statement of Work

– A conceptual description of a capability that considers the implementation of the System Level and Product Level Requirements

System Engineering Terminology - CLCS Products

- **CSCI**
  - **An aggregation of software and documentation that satisfies an end use function and is designated for configuration management.**
- **HWCI**
  - **An aggregation of configured hardware and documentation that satisfies an end use function and is designated for configuration management.**
- **Pathfinder Products/Activities**
  - **An aggregation of configured hardware, software and documentation that provides a method of proving a design and is not necessarily destined for configuration management.**

Other Products include: Documentation, Studies, Plans, etc...

A CLCS Delivery is defined by the Products Provided and The Capabilities Available to The User Communities

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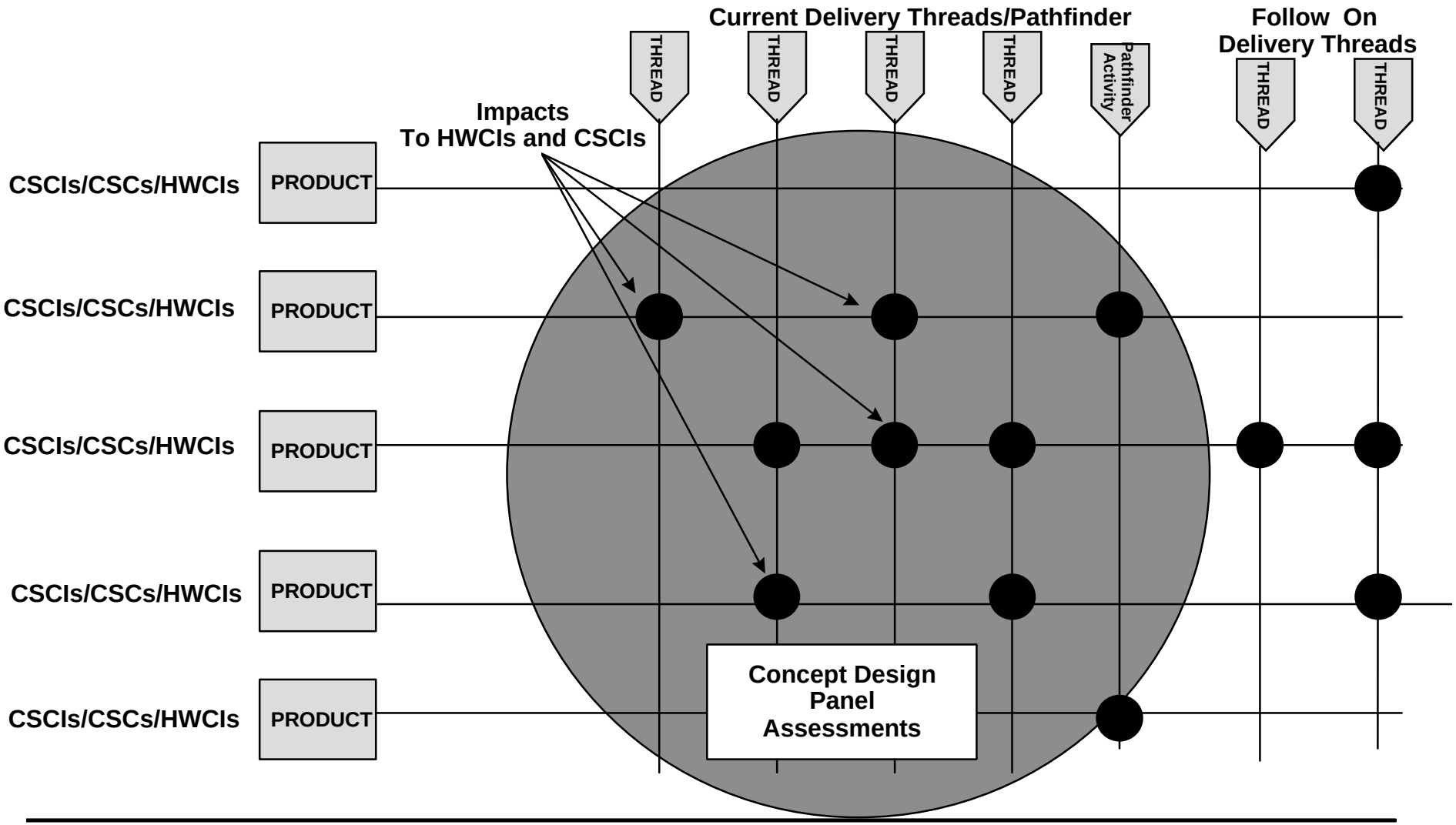
Delivery Products and Threads Relationship



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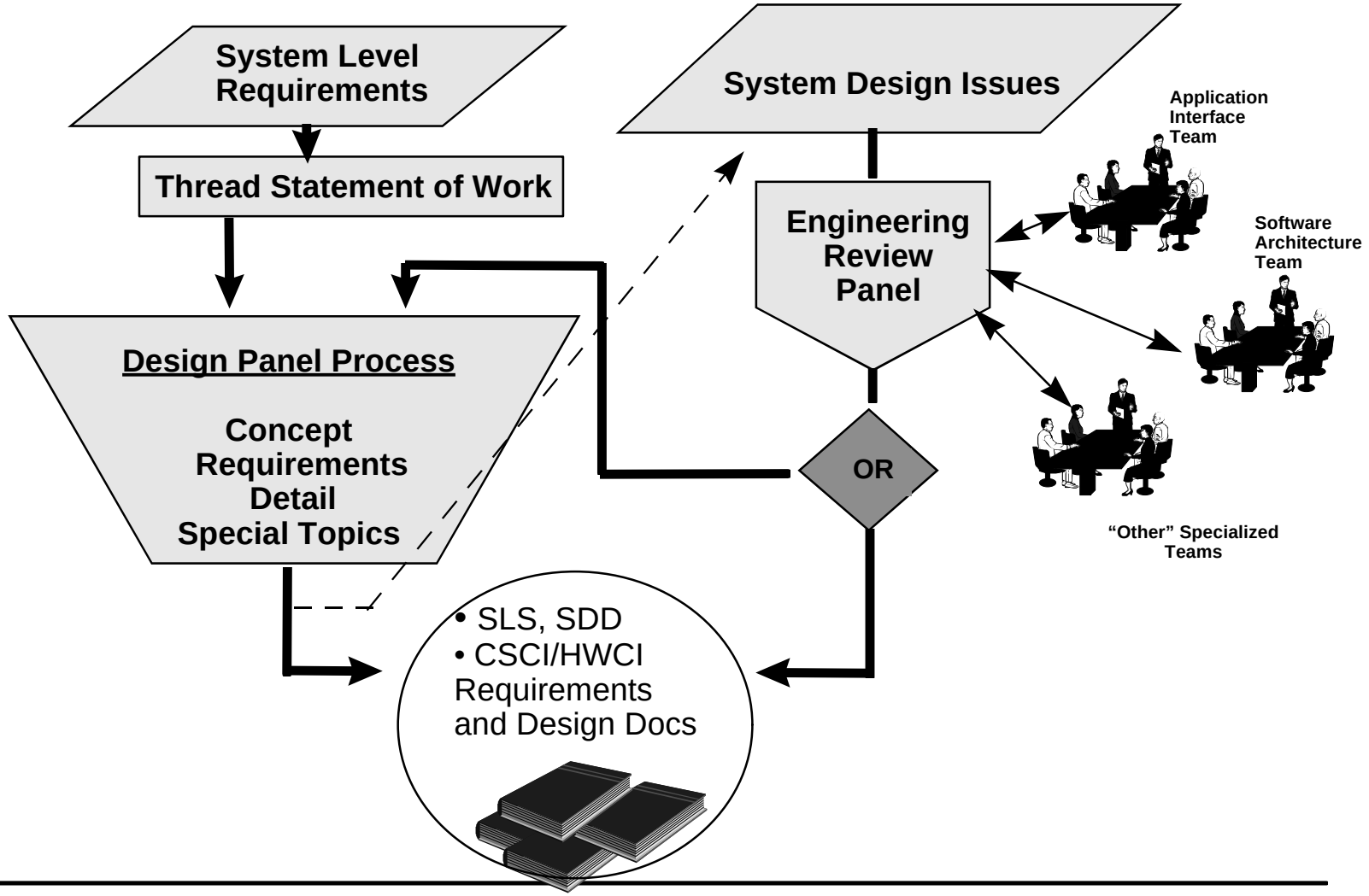
CLCS System Engineering Roles

- **Engineering Review Panel**
  - ***System Engineering Function responsible for the disposition and tracking of all system level issues as they arise***
    - » **Chaired by the System Design Lead**
    - » **Members Include Hardware Engineering, System Software, Application Software**
- **Design Panels**
  - ***System Engineering Function for Reviewing CLCS Product Design***
- **Thread Leads**
  - ***System Engineering Function responsible for the coordination of all impacted and dependent CSCIs for a delivered System Capability***
- **CSCI/HWCI Leads**
  - **Developer Function** ***responsible for the design and implementation of CLCS CSCI/HWCI. Provides incremental delivery of the CSCI product***

CLCS System Design Process



CLCS Design Panel Process

Process is Managed by
The Design Panel Chairmen

Minutes are kept by Design Panel Secretary

Design Panels

- ***Provide*** **the System Engineering and Development Community a Method of Communicating.**
- ***Allow*** **the User Communities to Gain Significant Insight Throughout the Dev. Process**
- ***Incrementally*** **Meet the Intent of Preliminary Design Review and Critical Design Review As Discussed in MIL-STD-1521 etc.**
- ***Supported*** **by the Project System Design Team**

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CLCS Design Panel Process - Thread/CSCI/HWCI Three Steps

Concept Design Panel *Represents a "Contract" Between System Engineering and the Development Communities*

- System Engineering Presentation Representing Concept of Thread Statement of Work Implementation
- Represents Development Community Work Assessment for a Particular System Thread
- Captures and Documents Development Schedule

Requirements Design Panel

- CSCI and HWCI Based Presentation
- Equivalent to a 'mini' Preliminary Design Review Per CSCI and HWCI
- Emphasizes Product Level Specifications in Response to all System Thread Impacts and Dependencies
- Identifies all External Interfaces and Top Level Data Flow Diagrams

Detailed Design Panel

- CSCI and HWCI Based Presentation
- Equivalent to a 'mini' Critical Design Review Per CSCI and HWCI
- Emphasizes the external design of the CSCI and HWCI

Special Topic Panel

- System Issue Resolution Forum
- Design Issue Discussion Forum

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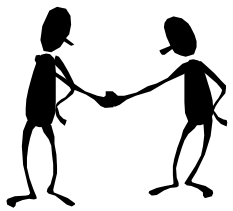
CLCS Design Panel Process



Concept Design Panel

Requirements Design Panel

Detailed Design Panel

Delivery Capability Agreement

Thread Lead and CSCI/HWCI Leads

Thread Kick-off

System Engineering Work Session

CSCI/HWCI Developer Work sessions

CSCI/HWCI Developer Work sessions

- Thread Concept
- CI Impacts Assessment
- Schedule

- Refined Concept
- Prelim. Product Specifications
- Prelim. Test Plans

- Refined Product
- Specifications
- Refined Data Flows
- Refined Specs

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Design Panel Process - Pathfinder HW and SW Activities

- The Design Panel Process plays a role in Pathfinder Activities
- Pathfinder Activities need not require the typical Concept, Requirements, and Detail Design Panels -- Special Topics Design Panel
- Pathfinder Activities need not require Quality oversight and system level acceptance testing
- Pathfinder Activities Include Trade Studies
- Examples of Pathfinder Activities
  - LCC-X Console Testbed
  - HMF Software Pathfinder
  - NT Based Platform for Human Computer Interface